

CLAIMS:

1. A method comprising:
monitoring at least one physiological parameter of a patient via a medical device that delivers a therapy to the patient;
determining a value of a metric that is indicative of sleep quality based on the at least one physiological parameter; and
controlling delivery of the therapy by the medical device based on the sleep quality metric value.
2. The method of claim 1, wherein monitoring at least one physiological parameter comprises monitoring at least one of activity level, posture, heart rate, respiration rate, respiratory volume, and core temperature.
3. The method of claim 1, wherein monitoring at least one physiological parameter comprises monitoring at least one of blood pressure, blood oxygen saturation, partial pressure of oxygen within blood, partial pressure of oxygen within cerebrospinal fluid, muscular activity, arterial blood flow, melatonin level within a bodily fluid, and galvanic skin response.
4. The method of claim 1, wherein the sleep quality metric comprises sleep efficiency, and determining the value of the sleep quality metric comprises:
identifying when the patient is attempting to sleep;
identifying when the patient is asleep; and
determining a percentage of time that the patient is asleep while the patient is attempting to sleep.

5. The method of claim 1, wherein the sleep quality metric comprises sleep latency, and determining the value of the sleep quality metric comprises:
 - identifying a first time when the patient begins attempting to sleep;
 - identifying a second time when the patient falls asleep; and
 - determining an amount of time between the first and second times.
6. The method of claim 1, wherein determining the value of the sleep quality metric comprises:
 - identifying when the patient is asleep; and
 - determining an amount of time that the patient is asleep during a period.
7. The method of claim 1, wherein determining the value of the sleep quality metric comprises:
 - identifying when the patient is asleep; and
 - identifying at least one of a number of arousal events and a number of apnea events during a period of sleep.
8. The method of claim 1, wherein determining the value of the sleep quality metric comprises:
 - identifying when the patient is within a sleep state; and
 - determining an amount of time that the patient was within the sleep state.
9. The method of claim 8, wherein the sleep state comprises at least one of an S3 sleep state and an S4 sleep state.
10. The method of claim 1, wherein determining a value of a metric that is indicative of sleep quality comprises:
 - determining a value of each of a plurality of sleep quality metrics; and
 - determining a value of an overall sleep quality metric based on the plurality of sleep quality metric values.

11. The method of claim 10, wherein determining a value of an overall sleep quality metric comprises applying a weighting factor to at least one of the plurality of sleep quality metric values.
12. The method of claim 1, wherein the sleep quality metric value comprises one of a mean and a median sleep quality metric value.
13. The method of claim 1, wherein controlling delivery of the therapy comprises:
comparing the sleep quality metric value to a threshold value; and
adjusting the therapy based on the comparison.
14. The method of claim 13, wherein the therapy comprises electrical stimulation, and adjusting the therapy comprises adjusting at least one of a pulse amplitude, pulse rate, pulse width and duty cycle of the stimulation.
15. The method of claim 14, wherein the therapy comprises neurostimulation.
16. The method of claim 13, wherein the therapy comprises a therapeutic agent, and adjusting the therapy comprises adjusting at least one of a dosage and an infusion rate for the therapeutic agent.
17. The method of claim 13, wherein adjusting the therapy comprises adjusting the therapy in an amount proportional to at least one of a difference and a ratio between the sleep quality metric value and the threshold value.
18. The method of claim 13, wherein adjusting the therapy comprises adjusting a therapy parameter within a specified range.
19. The method of claim 13, wherein adjusting the therapy comprises increasing the intensity of the therapy at a first rate and decreasing the intensity of the therapy at a second rate.

20. The method of claim 1, further comprising:
determining a plurality of values of the sleep quality metric over time;
associating each of the determined values of the sleep quality metric with a current therapy parameter set; and
for each of a plurality of therapy parameter sets, determining a representative value of the sleep quality metric based on the values of the sleep quality metric associated with the therapy parameter set, and
wherein controlling the therapy comprises automatically selecting one of the therapy parameter sets for delivery of the therapy based on the representative sleep quality metric values for the therapy parameter sets.
21. The method of claim 20, wherein the representative value for each of the therapy parameter sets comprises one of a mean value and a median value.
22. The method of claim 1, wherein the medical device delivers the therapy to the patient to treat chronic pain.
23. The method of claim 1, wherein the medical device comprises an implantable medical device.
24. A medical device comprising:
a therapy module to deliver a therapy to a patient; and
a processor to monitor at least one physiological parameter of a patient based on at least one signal received from at least one sensor, determine a value of a metric that is indicative of sleep quality based on the at least one physiological parameter, and control delivery of the therapy by the therapy module based on the sleep quality metric value.
25. The medical device of claim 24, wherein the processor monitors at least one of activity level, posture, heart rate, respiration rate, respiratory volume, and core temperature.

26. The medical device of claim 24, wherein the processor monitors at least one of blood pressure, blood oxygen saturation, partial pressure of oxygen within blood, partial pressure of oxygen within cerebrospinal fluid, muscular activity, arterial blood flow, melatonin level within a bodily fluid, and galvanic skin response.

27. The medical device of claim 24, wherein the sleep quality metric comprises sleep efficiency, and the processor identifies when the patient is attempting to sleep, identifies when the patient is asleep, and determines a percentage of time that the patient is asleep while the patient is attempting to sleep as the value of the sleep quality metric.

28. The medical device of claim 24, wherein the sleep quality metric comprises sleep latency, and the processor identifies a first time when the patient begins attempting to sleep, identifies a second time when the patient falls asleep, and determines an amount of time between the first and second times as the value of the sleep quality metric.

29. The medical device of claim 24, wherein the processor identifies when the patient is asleep, and determines an amount of time that the patient is asleep during a period as the value of the sleep quality metric.

30. The medical device of claim 24, wherein the processor identifies when the patient is asleep, and identifies at least one of a number of arousal events and a number of apnea events during a period of sleep as the value of the sleep quality metric.

31. The medical device of claim 24, wherein the processor identifies when the patient is within a sleep state, and determines an amount of time that the patient was within the sleep state as the value of the sleep quality metric.

32. The medical device of claim 31, wherein the sleep state comprises at least one of an S3 sleep state and an S4 sleep state.

33. The medical device of claim 24, wherein the processor determines a value of each of a plurality of sleep quality metrics, and determines a value of an overall sleep quality metric based on the plurality of sleep quality metric values.
34. The medical device of claim 33, wherein the processor applies a weighting factor to at least one of the plurality of sleep quality metric values to determine the value of the overall sleep quality metric.
35. The medical device of claim 24, wherein the sleep quality metric value comprises one of a mean and a median sleep quality metric value.
36. The medical device of claim 24, wherein the processor compares the sleep quality metric value to a threshold value, and adjusts the therapy based on the comparison.
37. The medical device of claim 36, wherein the therapy module delivers electrical stimulation, and the processor adjusts at least one of a pulse amplitude, pulse rate, pulse width and duty cycle of the stimulation based on the comparison.
38. The medical device of claim 36, wherein the therapy module delivers a therapeutic agent, and the processor adjusts at least one of a dosage and an infusion rate for the therapeutic agent based on the comparison.
39. The medical device of claim 36, wherein the processor adjusts the therapy in an amount proportional to at least one of a difference and a ratio between the sleep quality metric value and the threshold value.
40. The medical device of claim 36, further comprising a memory to store a specified range for a therapy parameter, wherein the processor adjusts the therapy parameter within the specified range.

41. The medical device of claim 36, wherein the processor increases the intensity of the therapy at a first rate and decreases the intensity of the therapy at a second rate.
42. The medical device of claim 24,
further comprising a memory to store information identifying a plurality of therapy parameter sets,
wherein the processor determines a plurality of values of the sleep quality metric over time, and associates each of the determined values of the sleep quality metric with a current one of the therapy parameter sets,
wherein, for each of the therapy parameter sets, the processor determines a representative value of the sleep quality metric based on the values of the sleep quality metric associated with the therapy parameter set, and stores the representative value of the sleep quality metric in association with the therapy parameter set within the memory, and
wherein the processor automatically selects one of the therapy parameter sets for delivery of the therapy based on the representative sleep quality metric values for the therapy parameter sets.
43. The medical device of claim 42, wherein the representative value for each therapy parameter set comprises one of a mean value and a median value.
44. The medical device of claim 24, wherein the medical device comprises an implantable medical device.
45. The medical device of claim 44, wherein the implantable medical device comprises one of an implantable neurostimulator and an implantable pump.
46. The medical device of claim 24, wherein the medical device delivers the therapy to the patient to treat chronic pain.

47. A computer-readable medium comprising instructions that cause a programmable processor to:

monitor at least one physiological parameter of a patient via a medical device delivers a therapy to the patient;

determine a value of a metric that is indicative of sleep quality based on the at least one physiological parameter; and

control delivery of the therapy by the medical device based on the sleep quality metric value.

48. The medium of claim 47, wherein the instructions that cause a programmable processor to control delivery of the therapy comprise instructions that cause the programmable processor to:

compare the sleep quality metric value to a threshold value; and
adjust the therapy based on the comparison.

49. The medium of claim 47, further comprising instructions that cause the processor to:
determine a plurality of values of the sleep quality metric over time;
associate each of the determined values of the sleep quality metric with a current therapy parameter set; and

for each of the therapy parameter sets, determining a representative value of the sleep quality metric based on the values of the sleep quality metric associated with the therapy parameter set, and

wherein the instructions that cause the programmable processor to control the therapy comprise instructions that cause the programmable processor to automatically select one of the therapy parameter sets for delivery of the therapy based on the representative sleep quality metric values for the therapy parameter sets.